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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/673,514	09/30/2003	Hideaki Miyoshi	243294US6YA	1592

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EXAMINER

ARANCIBIA, MAUREEN GRAMAGLIA

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 01/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/673,514

Applicant(s)

MIYOSHI ET AL.

Examiner

Maureen G. Arancibia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 November 2005.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
4a) Of the above claim(s) 20-49 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-19 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 11/4/05 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: There appears to be a discrepancy between the information presented in Figure 3 and the description of Figure 3 in the Specification (Paragraphs 31-42). Specifically, Step 340 in Figure 3 recites "igniting the plasma, **by providing a second RF signal** to the processing chamber." However, Paragraph 33 of the Specification recites, "In step 340, **after a plasma is ignited**, the first RF source provides a second TRF signal to the first electrode in the processing chamber." Is the second RF signal being applied **after** ignition or to **perform** ignition? Perhaps the "second RF signal" referred to in Step 340 of Figure 3 is actually the bottom RF (BRF) signal provided to the second electrode in the processing chamber, as described in Paragraph 32 of the Specification. Appropriate correction and clarification is required. Applicant is further requested to provide evidence of support for any correction or clarification in the original disclosure.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claims 1-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

Specifically, the Examiner notes that in the arguments filed on 4 November 2005, Applicant relies on Paragraphs 31, 37, 38, 45, and 46 of the Specification as providing

support for the amendment to independent Claim 1, which now recites "igniting a plasma **by changing an applied RF signal** from a first signal at a first RF frequency to a second signal at a second RF frequency." As discussed above, there is some ambiguity in what is actually disclosed in the Specification. In other words, it is not at all clear that Applicant discloses a dual-frequency ignition process. It therefore appears that this amendment may raise the issue of new matter. Again, Applicant is requested to clarify the support for this amendment in the original disclosure, in order for the Examiner to evaluate the appropriateness of a new matter rejection of the claims. For the purposes of the following examination on the merits, Claim 1 has been interpreted as performing ignition by changing a first RF signal to a second RF signal; i.e. a dual-frequency ignition. Claims 2-19 are rejected due to dependence on Claim 1.

4. Claims 5, 13, 14, and 17 are further rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 5 and 13 each recite the limitation "the first frequency source" in Line 2. There is insufficient antecedent basis for this limitation in the claim. Claims 14 and 17 are rejected due to dependence on Claim 5. For the purposes of the following examination on the merits, the "first frequency source" has been interpreted as referring to the source for the first RF frequency.

5. Claim 19 is further rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 19 recites the limitation "a second RF source" in Line 2. There is insufficient antecedent basis for this limitation in the claim, since Claim 1, on which Claim 19 depends, does not recite a first RF source. For the purposes of the following examination on the merits, the "second frequency source" has been interpreted as referring to a *source* for the RF frequency being supplied to the second electrode.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-3, 5, and 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Japanese Patent Application Publication 08-031753 to Tashiro et al. The following rejection refers to the English Machine Translation (EMT) of Tashiro et al.

Tashiro et al. teaches a method of operating a plasma processing system, comprising: positioning a substrate 107 on a substrate holder 106 in a processing chamber 104; initializing the plasma processing system (EMT, Paragraph 29); igniting a plasma by changing an applied RF signal from a first signal at a first RF frequency from RF power source 114 to a second signal at a second RF frequency from RF power

source 115 (*After it impresses first low frequencies...and this starts discharge...a VHF RF is impressed and it is made discharge by VHF*; Paragraphs 27, 31, and 49), wherein the applied RF signal is coupled to a first electrode 110 (Figure 1); and sustaining the plasma using the second signal applied to the first electrode at the second RF frequency (*plasma is maintained*; Paragraph 25).

In regards to Claims 2 and 3, the power level of the first signal is 50 Watts.
(EMT, Paragraph 30)

In regards to Claim 5, Tashiro et al. teaches coupling a first frequency source 114 that supplies the first RF signal to the first electrode 110 of the plasma processing system using a first matching network 112, and tuning the first matching network to an initial condition for plasma ignition. (EMT, Paragraph 30)

In regards to Claims 9 and 10, the first RF frequency of 13.56 MHz is more than 10% lower in frequency than the second RF frequency of 30-300 MHz. (EMT, Paragraphs 26 and 27)

In regards to Claim 11, Tashiro et al. teaches that the first signal is provided for a first time period, and the second signal is provided for a second time period. (i.e. each from a defined start time to an end time; EMT, Paragraphs 30 and 49; Figure 8)

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 4, 6-8 and 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tashiro et al. in view of U.S. Patent Application Publication 2003/0151372 to Tsuchiya et al.

The teachings of Tashiro et al. were discussed above.

In regards to Claim 4, Tashiro et al. teaches that the chamber pressure is 0.1 Torr. (Paragraph 29)

Tashiro et al. does not expressly teach that the process gas is any of the claimed process gases.

Tsuchiya et al. teaches that a process gas comprises a carbon- and fluorine-containing gas (CF₄). (Paragraph 68)

It would have been obvious to one of ordinary skill in the art to supply a carbon- and fluorine-containing gas to the plasma chamber taught by Tashiro et al., as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 68), would have been to perform plasma etching, in instead of the coating taught by Tashiro et al.

In regards to Claims 6-8, Tashiro et al. does not expressly teach that the first RF frequency is greater than 40 MHz, and at least 10% higher in frequency than the second RF frequency.

Tsuchiya et al. teaches that a first RF frequency used to ignite the plasma can be 60 MHz, which is more than 10% higher in frequency than a second RF frequency of 13.56 MHz used to sustain the plasma. (Paragraph 51)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to have the first RF frequency used to ignite the plasma be greater than 40 MHz and more than 10% higher in frequency than a second RF frequency used to sustain the plasma, as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraphs 9-15), would have been to increase plasma generation efficiency by igniting the plasma with a frequency in the VHF band, but to avoid weakening the sheath electric field by having the frequency be too high during processing.

In regards to Claims 13 and 14, Tashiro et al. does not expressly teach the recited steps.

Tsuchiya et al. teaches that a plasma processing method can comprise: determining a forward power for a first RF signal used to ignite the plasma and being provided by the first frequency source; determining a reflected power for the first signal being returned to the first frequency source; and determining when the plasma has been ignited using the forward power and the reflected power. (Paragraphs 59-65 and 108)

It would have been obvious to one of ordinary skill in the art to include the steps taught by Tsuchiya et al. of determining ignition using forward and reflected power in the method taught by Tashiro et al. The motivation for making such a modification, as taught by Tashiro et al. (Paragraph 60), would have been to allow the impedance of the matching unit to be optimized at the moment of plasma generation.

In regards to Claims 15 and 16, Tashiro et al. does not expressly teach the claimed steps.

Tsuchiya et al. teaches that the ignition and maintenance of the plasma are determined using at least one optical frequency obtained by an optical frequency monitoring system coupled to the processing chamber. (Paragraphs 73, 78, 79, 82)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to include the detection steps taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraphs 79-82), would have been to use an alternate means of detecting plasma generation, both to ensure plasma generation and to allow for the timed optimization of the process settings.

In regards to Claims 17 and 18, Tashiro et al. does not expressly teach the claimed steps.

Tsuchiya et al. teaches tuning the first matching network from the initial condition to an operating condition, and verifying that the plasma has not extinguished. (Paragraphs 90-97) Tsuchiya et al. also teaches that the first matching network is tuned from the initial condition to the operating condition in less than 4 seconds (about 1 second). (Paragraphs 117 and 121)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to include the tuning and verification steps as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 90), would have been to optimize the impedance of the matching

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network at the moment of ignition to maximize the proportion of RF power coupled with the plasma and retain the plasma efficiently.

In regards to Claim 19, Tashiro et al. does not expressly teach coupling an RF source to the second electrode and providing additional power to the plasma.

Tsuchiya et al. teaches that a plasma processing method further comprises coupling an RF source 50 to second electrode (and substrate support) 5; and providing additional power to the plasma. (Paragraphs 56 and 57)

It would have been obvious to one of ordinary skill in the art to couple another RF source to the second electrode taught by Tashiro et al. and to supply additional power to the plasma, as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 56), would have been to generate a self-biasing voltage at the substrate to be processed to control the ion incidence on the substrate.

10. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tashiro et al. in view of U.S. Patent 5,441,596 to Nulty.

The teachings of Tashiro et al. were discussed above in regards to Claim 11.

In regards to Claim 12, Tashiro et al. does not expressly teach that the first time period has a duration that ranged from about 10 ms to about 1 s.

Nulty teaches that a first RF signal can be applied for a time period of 1 s. (Column 4, Lines 1-16)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to have the first time period be only 1 s long. The motivation for

making such a modification, as taught by Nulty (Column 2, Lines 37-45, Column 4, Lines 1-16, Column 6, Lines 47-56), would have been to consistently, repeatably ignite the plasma while still expanding the operating range of the plasma process to higher powers and lower pressures.

Response to Arguments

11. Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

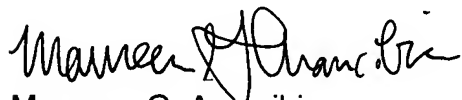
13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571)

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272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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